

RESEARCH ARTICLE ON FORMULATION AND EVALUATION OF BRYOPHYLLUM LEAF SYRUP

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Abstract

The present study focuses on the formulation and evaluation of a herbal syrup prepared from Bryophyllum pinnatum leaves, a medicinal plant widely recognized for its therapeutic properties in traditional medicine. The plant exhibits various pharmacological activities such as antiinflammatory, antimicrobial, antioxidant, analgesic, and wound-healing effects, making it a promising candidate for herbal drug development. In this study, fresh leaves of Bryophyllum pinnatum were collected, cleaned, and subjected to aqueous extraction using the maceration method. The obtained extract was then concentrated and formulated into a syrup using suitable pharmaceutical excipients.

Keywords: Bryophyllum pinnatum, Herbal syrup, Formulation, Evaluation, Antimicrobial, Antiinflammatory, Stability study, Excipients, Organoleptic properties, Pharmaceutical parameters

1. Introduction

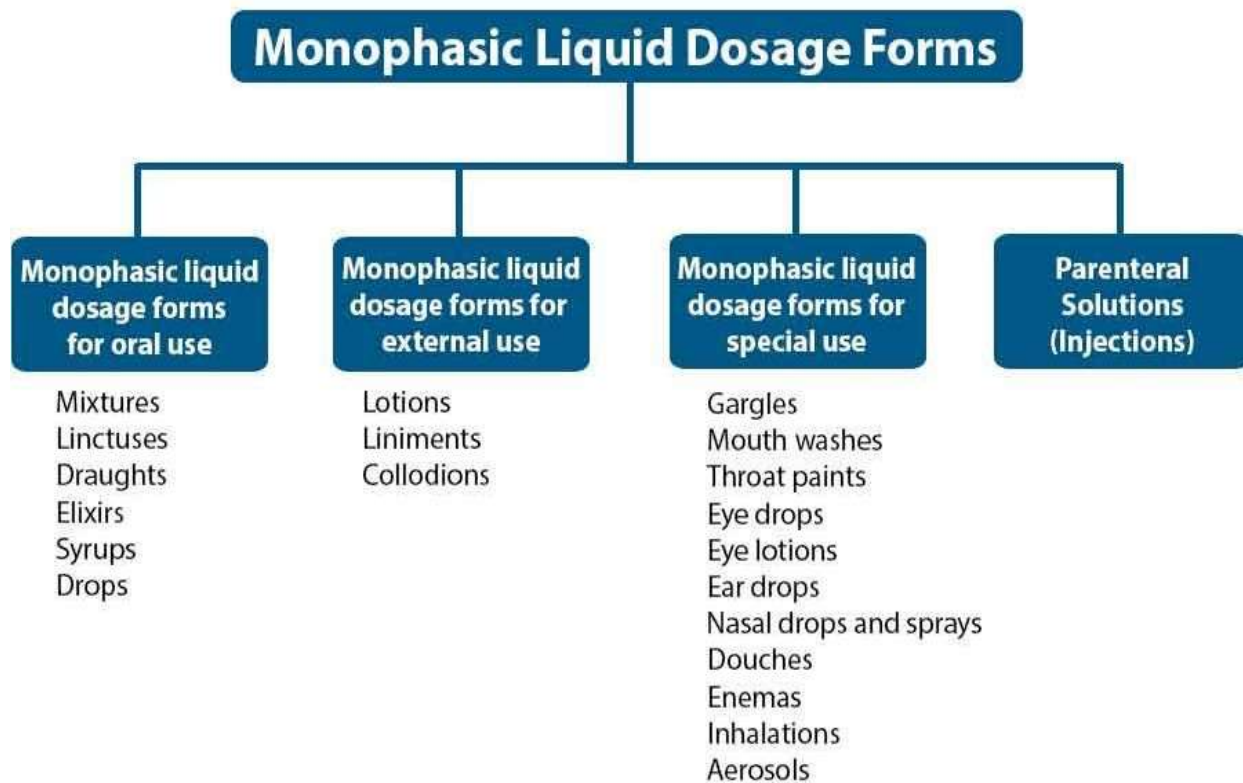
Bryophyllum syrup is a herbal formulation made from the extract of Bryophyllum pinnatum, commonly known as "Patharchatta," "Miracle Leaf," or "Life Plant." This syrup is widely used in traditional Ayurvedic and folk medicine for its broad range of therapeutic properties. Known for its anti-inflammatory, diuretic, antimicrobial, and wound-healing effects, Bryophyllum syrup is especially valued for supporting kidney health, treating urinary disorders, and aiding in the natural management of kidney stones. The syrup is easy to consume and is often recommended as a natural remedy for respiratory issues, digestive complaints, and skin conditions. Its soothing and detoxifying nature makes it a popular choice for holistic wellness and preventive care.

Syrups are adaptable sweeteners that can be used to enhance the sweetness and richness of a variety of foods and drinks. They are available in a variety of tastes and forms. They give a range of flavors from straightforward sweetness to intricate fruit or nutty overtones, and they are essential in augmenting taste and texture. Syrups can improve a meal or drink's overall flavor by acting as a finishing touch or basic ingredient. They are a dynamic ingredient in culinary creations because of the wide variations in their viscosity, sweetness, and flavour profiles. Because of various oxidative reactions and stress conditions in the body that produce free radicals, antioxidant syrup is used to cure cancer. By utilizing this syrup, the condition is resolved. Evaluation and formulation were carried out on a laboratory scale. PH, viscosity, density, stability

testing during evaluation formulation was determined to be stable for a number of parameters, and prepared for use as a cough remedy.

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We can investigate the wide variety of sweeteners that contribute significantly to the flavor enhancement of different foods and beverages. There are several types of syrups, and each one has a distinct flavor and texture that can elevate simple recipes to spectacular culinary masterpieces. Every variety of syrup, from rich maple syrup to traditional simple syrup, has a unique sweetness and flavor profile. Knowing the qualities of various syrups can lead to a plethora of opportunities in baking, mixology, and cookery. Types of syrup: Solutions, suspensions, syrups, elixirs, and emulsions are a few typical varieties. Every kind has unique qualities and applications involving patients' drugs. Whereas suspensions contain solid particles scattered throughout a liquid media, solutions are uniform mixtures of a medication in a liquid basis. While elixirs are sweetened hydroalcoholic solutions, syrups are concentrated sugar solutions in water with additional flavouring. Emulsions are mixtures stabilized by an emulsifying agent of two immiscible liquids.



2. Plant Profile

2.1 Bryophyllum pinnatum

India is the herbal garden of the world and has been a source of plants and its products, since antiquity, man uses them in different way according to his needs, particularly as food and medicine. The name Bryophyllum comes from 'I sprout' and 'leaf', the plant, classified as a weed is notorious for its growth potential. They widely grow in hot and humid areas, around the dwelling places, along road sides and in abandoned farm and fields. They are widely used in folk medicine of its indigenous region (Madagascar, Tropical Africa, India, China, Australia, Hawaii and Tropical America).

2.2 DRUG PROFILE



Fig No.01 Bryophyllum Leaf

2.3 Taxonomical Classification of *Bryophyllum pinnatum*

A perennial plant thrives in India's wet and hot regions, like Bengal. It has 25 genera and 450 species. Succulent perennials have hollow stems, four-angled leaves, and numerous branches. The leaves are 10-20 cm long and decussate. A long petiole surrounds the three- to seven-foliolate top leaf. They are dark green and scalloped with red ribbons. 30-35 cm long, 2-4 cm petioles, 6-8 X 3-5.5 cm blades, with latent buds that can develop into healthy plantlets with an acute tip. Rooting vegetative buds are on the leaves. The terminal panicle is 10-40 cm long. Pendulous bell-shaped flowers blanket the ground. The calyx tube is 2-4 cm long, with oval shaped nectar scales, oblong stamens, and follicles in the petal and calyx. The four-septate fruit-pod contains numerous smooth, ellipsoid seeds. From November to March, the plant is at its most productive. This has a hot, astringent, acidic, and sweet after taste. Various chemical constituents in the plant *Bryophyllum pinnatum* is a succulent perennial plant that grows 3-5 feet tall. Commonly known as 'air plant,' it has tall hollow stems, fleshy dark green leaves that are distinctively scalloped and trimmed in

red, and bell-like pendulous flowers. Kalanchoe is botanically classified with two main Latin names which refer to the same plant. *Bryophyllum pinnatum* / *Kalanchoe pinnatum* *Bryophyllum pinnatum* is a medicinal plant largely used in Folk medicine (Traditional medicine) for the treatment of kidney stones, gastric ulcer, pulmonary infection, rheumatoid arthritis etc. *Kalanchoe pinnata* has become naturalized in temperate regions of Asia, Australia, New Zealand, West Indies, Macaronesia, Mascarenes, Galapagos, Melanesia, Polynesia, and Hawaii. In many of these, such as Hawaii, it is regarded as an invasive species. In French Polynesia, *Kalanchoe pinnata* has been declared a threat to biodiversity.

3. Plant Profile

Rank	Classification
Kingdom	Plantae
Sub Kingdom	Tracheobionta
Subdivision	Magnoliophyta
Class	Magnoliopsida
Subclass	Rosidae
Order	Rosales
Family	Crassulaceae
Genus	<i>Bryophyllum</i>
Species	<i>Bryophyllum pinnatum</i>

Table No 1 Taxonomical classification

4.0 Mechanism of Action

- 1) Kidney Stone –Prevent the forming of calcium oxalate crystal deposition in renaltubules. This plant reduces the size of calcium oxalate stones and preventive action of urolithiasis.4Formulation and Development Agnihotri Institute of Pharmacy, Wardha
- 2) Antimicrobial Action - Showed the bacterial action against gram + and gram - and shows action against fungus.2
- 3) Anti- inflammatory Action - By inhibition of releases of histamine and cytokine information.2

4.1 Pharmacological action.

- 1) Anti-allergy activity: An in vitro study has shown that the plant is helpful in reducing allergy. Its anti-allergic effect is due to the halting of antigen induced mast cell degranulation and also by minimizing the secretion of histamine.5
- 2) Anti-diabetic activity: For many years, the plant has been utilized for its anti hyperglycemic effects. The aqueous extract of leaves, after postprandial and streptozotocin induced diabetes in rats has exhibited striking hypoglycemic effects.5
- 3) Antimicrobial and Antifungal activity: The plant different crude extracts were analyzed for their anti- microbial effect and it was determined that the extracts have broad spectrum anti-bacterial activity.5
- 4) Wound healing activity: The plant is used topically for the healing of wounds in traditional therapeutics. It is proposed that the plant has saponin in huge amounts which promote wound healing by aggregating the erythrocytes.5

4.2 Advantages:

- 1) Treats kidney diseases.
- 2) Useful in urinary disorder.
- 3) For hypertension.
- 4) Cures bleeding diarrhoea.
- 5) For treating Diabetes.

4.3 Disadvantages:

- 1) Stomach pain.
- 2) Heartburn.



Fig No:02 Bryophyllum leaf (Kalanchoe pinnata)

Synonyms:

- *Kalanchoe pinnata* (most widely accepted scientific name)
- *Bryophyllum pinnatum*
- *Kalanchoe calycinum*
- *Cotyledon pinnata* (older synonym)

Biological Source:

Bryophyllum is obtained from the fresh or dried leaves of *Kalanchoe pinnata* (Lam.) Pers., belonging to the family Crassulaceae.

Botanical name: *Kalanchoe pinnata* (Lam.) Pers

Family: Crassulaceae **Part use:** Leaves **Chemical Constituents:**

1. Flavonoids Quercetin

Kaempferol Rutin
(Antioxidant, anti-inflammatory)

1. Glycosides Bryophyllin A & B (Antitumor, insecticidal)
2. Triterpenoids Oleanolic acid Ursolic acid
(Anti-inflammatory, hepatoprotective)
3. Steroids Stigmasterol β -sitosterol
(Cholesterol-lowering, anti-inflammatory)
4. Alkaloids
(Analgesic, antimicrobial activity)
5. Phenolic Compounds Gallic acid
Caffeic acid
(Antioxidant, antimicrobial)
6. Bufadienolides
(Cardiotonic activity – similar to cardiac glycosides)
7. Mucilage and Tannins (Soothing, astringent properties) **Pharmaceutical Uses:**
 1. Wound Healing Agents

Leaf extracts and gels are used in herbal creams and ointments for cuts, burns, and ulcers.

2. Antimicrobial Formulations

Used in herbal medicines to treat skin infections and microbial wounds.

3. Anti-inflammatory and Analgesic Drugs

Incorporated into pain relief and anti-swelling formulations.

4. Respiratory Ailments

Used in syrups and decoctions for asthma, cough, and bronchitis.

5. Nephroprotective Remedies

Herbal preparations for kidney stones and urinary tract infections.

6. Antidiabetic Products

Included in supplements and capsules for managing blood sugar levels.

7. Herbal Eye Drops (in traditional systems)

Used to treat conjunctivitis and other inflammatory eye conditions.

5.0 Industrial Uses:

1. Herbal Cosmetic Industry

Extracts used in skin care creams, lotions, and healing gels due to soothing and regenerating properties.

2. Nutraceuticals

Leaf powder or extract included in health supplements for immune-boosting and antioxidant benefits.

3. Biopesticide Industry

Bryophyllin compounds show insecticidal activity and are being explored for eco-friendly pesticides.

4. Ayurvedic and Herbal Medicine Manufacturing

Widely used in Ayurvedic, Siddha, and Unani systems for multiple formulations.

6.0 Morphological Characteristics:

1. Type:

Simple leaf, succulent (fleshy and thick), soft and juicy.

2. Shape:

Ovate to oblong with a rounded or slightly heart-shaped base.

3. Margin:

Crenate (scalloped or bluntly toothed).

Small plantlets (adventitious buds) often grow along the notches on the leaf margin — a unique feature.

4. Apex:

Rounded to slightly pointed.

1. Color:

Bright green; may appear reddish or purplish along the margins in strong sunlight.

2. Venation:

Reticulate (net-like), prominent midrib.

3. Arrangement:

Opposite or whorled on the stem.

4. Surface:

Smooth, shiny, and glabrous (non-hairy).

7.0 PLAN OF WORK

1. Literature Review and Problem Identification

Study traditional uses of *Bryophyllum pinnatum* in different medicinal systems. Explore documented pharmacological activities (e.g., anti-inflammatory, antimicrobial). Identify existing formulations (if any) involving *Bryophyllum*. Review herbal syrup formulation techniques and standard evaluation protocols. Establish research gaps and define objectives.

2. Collection and Authentication of Plant Material

Collect fresh Bryophyllum pinnatum leaves from a trusted local or botanical source. Submit plant material to a botanist or institutional herbarium for authentication. Assign voucher specimen number for future reference.

3. Preparation of Plant Material

Wash leaves thoroughly with water to remove dust and contaminants.

Air-dry the leaves under shade to prevent degradation of heat-sensitive compounds. Grind dried leaves into coarse powder using a mechanical grinder. Store powdered leaves in an airtight container for extraction.

4. Extraction of Phytoconstituents

Choose aqueous extraction method (cold maceration or hot infusion). Maintain appropriate solvent-to-material ratio (e.g., 1:10). Macerate for 48–72 hours with occasional stirring.

Filter the extract using muslin cloth and Whatman filter paper. Concentrate the filtrate using a rotary evaporator under reduced pressure.

5. Phytochemical Screening (Optional but Recommended)

Perform preliminary phytochemical tests to identify presence of: Flavonoids, Alkaloids, Tannins, Phenolics, Glycosides. Record qualitative results for formulation consideration.

6. Formulation of Herbal Syrup Develop a base syrup using:

Sucrose (vehicle/sweetener), Glycerin or sorbitol (humectant/stabilizer), Citric acid (pH modifier), Sodium benzoate or potassium sorbate (preservative). Dissolve extract into base syrup under continuous stirring and gentle heat. Filter the final syrup and transfer to sterilized amber glass bottles. Label and store under controlled conditions.

8.0 Evaluation Of Syrup Formulation

A. Organoleptic Evaluation

Color, Odor, Taste

B. Physicochemical Evaluation

pH (digital pH meter), Viscosity (Brookfield viscometer), Specific gravity (pycnometer method), Total solid content (evaporation method), Refractive index (optional)

A. Microbiological Evaluation

Total viable count, Tests for: Escherichia coli, Staphylococcus aureus, Salmonella spp., Fungal growth (yeasts and molds)

7. Stability Studies

Store samples at: Room temperature ($25 \pm 2^\circ\text{C}$), Refrigeration ($4\text{--}8^\circ\text{C}$), Accelerated ($40^\circ\text{C} \pm 2^\circ\text{C}$, 75% RH). Monitor for up to 3 months. Evaluate changes in: Color, pH, Precipitation or sedimentation, Microbial growth.

8. Data Compilation and Analysis

Record all results in structured tables and graphs. Use statistical tools (e.g., mean, standard deviation) to assess consistency. Compare with established standards for herbal syrups (WHO/AYUSH guidelines).

9. Conclusion and Recommendations

Summarize findings regarding quality, stability, and potential of the formulation. Address any limitations encountered. Propose future directions for: In vivo studies Clinical validation Commercial potential

9.0 DRUG PROFILE :

Materials:

sr. no	Composition	Role of Materials
1	Bryophyllum leaf extract	By reducing the size of stone and formation of Ca _{ox} .
2	Gokhru	Anti-lithiasis property
3	Giloy	Dissolve kidney stone
4	Kutki	Antioxidant property
5	Pashan bhed	Anti-lithic property
6	Glycerin	thickening agent
7	Crystal clear water	As solvent

10. METHODS:

A. Collection and Authentication of Plant Material:

Fresh Bryophyllum pinnatum leaves were collected and authenticated by a certified botanist. The leaves were washed thoroughly with distilled water to remove dust and surface contaminants.

B. Preparation of Extract:

Fresh leaves were crushed using a blender or mortar and pestle to obtain a thick juice. The juice was filtered using a muslin cloth followed by Whatman filter paper to obtain a clear extract.

Alternatively, for dry extract, the leaves were shade-dried and then powdered. The powder was macerated in distilled water or ethanol for 48 hours, filtered, and concentrated using a water bath.

C. Formulation of Syrup: Ingredients:

Bryophyllum leaf extract – 25% v/v Sucrose – 66.7% w/v

Sodium benzoate – 0.1% w/v Distilled water – q.s. to 100 ml

Flavoring agent – 0.2% v/v (optional)

11. PROCEDURE:

1. Prepare simple syrup by dissolving sucrose in distilled water using mild heat. Allow it to cool.
2. Mix the Bryophyllum extract into the cooled syrup with continuous stirring.
3. Add sodium benzoate as a preservative and flavoring agent if desired.
4. Filter the syrup through muslin cloth.
5. Store in clean, sterilized, amber-colored bottles for further evaluation

Formulation Technique:(Another method)

1. Collection and Authentication:

Fresh Bryophyllum pinnatum leaves are collected and authenticated by a botanist.

2. Washing and Drying:

Wash thoroughly with distilled water to remove dirt. Optionally shade-dry if preparing extract from dried material.

3. Extraction:

Crush fresh leaves to obtain juice or perform aqueous/ethanolic extraction using maceration. Filter the extract using muslin cloth or Whatman filter paper.

4. Syrup Formulation:

Ingredients:

Bryophyllum leaf extract/juice Sucrose (60–66% w/v) Sodium benzoate (0.1% w/v) Purified water
 Flavoring agent (optional)

9.0 FORMULATION :

Ingredient	Quantity	Role
Bryophyllum leaf Extract	10ml	Active Ingredient
Propylene glycol	5 ml	Co-solvent, humectant
Glycerin	3 ml	Humectant, viscosity enhancer
Alcohol	3 ml	Solvent, preservative aid
Water	1 ml	Solvent
Sucrose	65 g	Sweetening agent, vehicle (syrup base)
Sodium benzoate	0.2 g	Preservative
Distilled water	q.s to 100 ml	Vehicle

Table No.03 Formulation F1

Ingredient	Quantity	Role
Bryophyllum leaf Extract	15ml	Active Ingredient
Propylene glycol	10 ml	Co-solvent, humectant
Glycerin	5 ml	Humectant, viscosity enhancer
Alcohol	5 ml	Solvent, preservative aid
Water	2 ml	Solvent
Sucrose	60 g	Sweetening agent, vehicle (syrup base)
Sodium benzoate	0.2 g	Preservative
Distilled water	q.s to 100 ml	Vehicle

Table No.04 Formulation F2

Ingredient	Quantity	Role
Bryophyllum leaf Extract	20ml	Active Ingredient
Propylene glycol	12 ml	Co-solvent, humectant
Glycerin	6 ml	Humectant, viscosity enhancer
Alcohol	6 ml	Solvent, preservative aid
Water	4 ml	Solvent
Sucrose	55 g	Sweetening agent, vehicle (syrup base)
Sodium benzoate	0.2 g	Preservative
Distilled water	q.s to 100 ml	Vehicle

Table No.04 Formulation F2

12 EVALUATION

Sr. No.	Parameter	Method / Description	F1 Result	F2 Result	F3 Result
1	Organoleptic Properties	Color, taste, odor, appearance	Light green, sweet, pleasant odor, clear	Green, sweet, slightly viscous	Dark green, sweet, thick
2	pH	Digital pH meter	4.5	5.2	5.8
3	Viscosity (cP)	Ostwald viscometer	1.25 cP	1.45 cP	1.70 cP
4	Specific Gravity	Pycnometer method	1.10	1.18	1.25
5	Density (g/ml)	Weight/Volume	1.08 g/ml	1.15 g/ml	1.22 g/ml
6	Total Solid Content (%)	Evaporation method	62%	68%	74%
7	Sugar Content (%)	Fehling's method	58%	64%	70%

13 RESULTS AND DISCUSSION

The Bryophyllum pinnatum leaf syrup was successfully formulated in three different formulations, namely F1, F2, and F3, by varying the concentration of excipients such as sucrose, glycerin, and propylene glycol. All three formulations were subjected to organoleptic, physicochemical, and microbiological evaluation.

The organoleptic evaluation revealed that all formulations exhibited acceptable characteristics. Formulation F1 showed a light green color with a pleasant odor and a clear appearance. F2 appeared green and slightly more viscous, while F3 exhibited a darker green color with a thicker consistency. All formulations had a sweet taste, although a slight herbal bitterness was present, which was effectively masked by the syrup base. No precipitation or turbidity was observed in any formulation, indicating good physical stability.

The physicochemical evaluation showed variation among the three formulations. The pH values were found to be 4.5 for F1, 5.2 for F2, and 5.8 for F3, all within the acceptable range (4–6) for oral syrups, ensuring stability and compatibility. The viscosity increased progressively from F1 (1.25 cP) to F2 (1.45 cP) and F3 (1.70 cP), indicating that higher excipient concentration contributed to increased thickness. Similarly, specific gravity values were 1.10 (F1), 1.18 (F2), and 1.25 (F3), confirming an increase in density with formulation concentration. Total solid content also followed an increasing trend: 62% in F1, 68% in F2, and 74% in F3. Sugar content ranged from 58% to 70%, supporting adequate sweetness and preservation capacity. These results confirm that all formulations meet standard pharmaceutical requirements.

The microbiological evaluation demonstrated that all three formulations were within acceptable limits for total viable count, and no pathogenic organisms such as *E. coli*, *Staphylococcus aureus*, or *Salmonella* were detected. This indicates that the formulations were microbiologically safe and that the preservative system used was effective. Additionally, phytochemical screening confirmed the presence of important bioactive compounds such as alkaloids, flavonoids, and tannins in all formulations, which contribute to the therapeutic activity of the syrup.

The preservative efficacy test showed moderate effectiveness in F1, good effectiveness in F2, and excellent effectiveness in F3. This suggests that higher concentrations of excipients and preservatives improve the stability and shelf-life of the formulation.

14 CONCLUSION:

The present study successfully demonstrated the formulation and evaluation of a herbal syrup using *Bryophyllum pinnatum* leaf extract. The syrup was prepared using suitable excipients and evaluated for various organoleptic, physicochemical, and microbiological parameters. All three formulations (F1, F2, and F3) showed acceptable characteristics, confirming the feasibility of developing a stable herbal syrup from this medicinal plant.

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